For information of
Regional Forester
Attention: Mr. Koch

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

THE SEVENTH ANNUAL SURVEY OF THE MOUNTAIN PINE BEETLE INFESTATION IN THE COEUR D'ALENE NATIONAL FOREST

DEC 23 1935
FOREST MANAGEMENT

By
T. T. Terrell
Scientific Aid

Forest Insect Laboratory
Coeur d'Alene, Idaho
Dec. 20, 1935

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Insect Control

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY & Plant Quarantine
WASHINGTON, D.C.

FOREST ENTOMOLOGY
Refer to file
Project C-1

Forest Insect Laboratory
Coeur d'Alene, Idaho
Dec. 20, 1935

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DEC 21 1935
FOREST MANAGEMENT
Ans.

Regional Forester
Missoula
Montana

Dear Sir: Attention of Mr. Koch

There is enclosed a copy of Mr. Terrell's report covering the 1935 survey of the Coeur d'Alene National Forest. I am indeed sorry that we have been so long in getting this report into your hands and assure you that I shall make every possible effort to prevent a recurrence of such a delay.

The situation on the Coeur d'Alene Forest is indeed a difficult entomological problem to analyze. There are so much conflicting data available that one can really take any line of reasoning and prove his point. However, there is no doubt in my mind but that as a result of the control measures which were first instituted in 1930 a serious infestation has been prevented. There is, however, a doubt as to the effectiveness of the maintenance control which we are now doing. For the past two or three years control measures have been instituted within areas where the infestation was increasing. In some cases a reduction followed the institution of control, while in others there was no material change in the status of the infestation. Furthermore, there did not seem to be any greater changes in the status of the infestation on the areas left untreated than on those covered by maintenance control. Though we recognize the difficulty of actually measuring the results of control, as a result of this condition we are sometimes inclined to believe that the epidemic has been reduced to as low a point as can be economically reached with artificial control.

Some few years ago we recognized that 100 percent control was economically impossible, as owing to the human factor involved we were unable to secure more than 85 to 95 percent efficiency from our spotting crews. Furthermore, it was recognized that a large percentage of the trees missed by spotters were those carrying the greatest potential power of reinfestation. The trees missed are usually those which show

no external evidence of attack, such as discolored foliage, woodpecker work, and so forth. As the beetle broods from these late attacks are not developed sufficiently to be attractive material for the attacks of parasites and predators, these trees contain few, if any, of these beneficial insects, and the resulting broods are nearly always heavy. To make this a still more serious problem, it was realized that the trees which are seldom missed by the spotters and are subsequently treated are the ones containing the heaviest degree of parasitism. This condition follows the fact that the early attacks, which are always more heavily parasitized, show discolored foliage and woodpecker work. To overcome this apparent weakness in artificial control it was decided that further attempts to secure 100 percent control by treating all trees would be discontinued, and that trees containing a certain degree of parasitism would be left untreated. This plan was adopted during the past two years of control. Though the results secured from this innovation in control are not very tangible, we still believe in the soundness of the theory and feel that unless artificial control measures are directed towards the preservation of the natural enemies of this insect, all that control can accomplish is a reduction in the insect population, with no change in the potential power of the infestation to increase.

The 1935 infestation is not as startling as we first assumed it would be, as for the entire Forest there is an 11 percent decrease in the number of infested trees. However, the loss of timber is higher, as the percentage of infested windfalls, which in the past have been considered as infested trees, decreased from 47 percent of the total infestation in 1934 to 16 percent in 1935. With this decrease in the number of windfalls there has naturally been an increase in the severity of the attacks, as standing trees are more resistant and successful attacks require a heavier concentration of insects. Mr. Terrell states that he has never recorded or observed heavier attacks in white pine than occurred this year on the Coeur d'Alene National Forest. This condition can either be taken as a hopeful sign or one to the contrary. One can believe that when mountain pine beetle attacks occur in such severity as recorded for this Forest, some being as heavy as 25 per square foot of bark surface, that food competition will become so great that a severe mortality will follow. However, we do not have any positive data on what might be considered a saturation point in the number of attacks per square foot, so can not be positive in such a position. On the other hand, from such attacks one could also believe that there will be a heavy emergence.

A hopeful indication is the fact that these heavily attacked trees contain large numbers of parasites. Mr. Terrell is of the opinion that these heavy attacks, together with the fact that the infested trees are now occurring in rather large groups where heretofore they have been in small groups or as single individuals, mark a phase in the cycle of the infestation that can be taken as indicating the peak of the epidemic, and though he expects a slight increase in the infestation in 1936, during the next two or three years the outbreak will decline very rapidly. This is but an opinion and one which we can not substantiate with data, aside from the fact that the outbreak which occurred on the Coeur d'Alene National Forest between 1910 and 1920 seemed to reach its peak with the 1914 attacks occurring in large groups throughout the Forest. This is again a conjecture and can not be supported.

To summarize this somewhat rambling analysis of the situation, it is indeed evident that there are many phases in relation to the cycle of an infestation upon which we must have further information. We must be able to recognize the significance of such conditions as now exist on the Coeur d'Alene, and will plan to secure this information at once.

The Sissons and Yellow Dog areas still remain the apparent sore spot on the Forest. Control measures were instituted on these areas last year, with parasite trees being left untreated, but, as you will note from Mr. Terrell's report, the areas were not thoroughly covered. In fact, the reinfestation of these units could easily have originated from the infested bark surface left untreated, and is not directly attributable to the parasite trees which were left. However, we realize that these trees were also a factor, as there was nothing to prevent the remaining broods from emerging and attacking in 1935. Control measures conducted on lower Flat Creek, Bennett Creek, and Rock City, under an NIRA appropriation, were extremely successful, showing reductions of 85 percent, 60 percent and 45 percent respectively. The NIRA project on Brett-Miner was not so successful. It is possible that the 1931 fire, which is adjacent to this area, is still having some influence, though it would seem that its effect should be over by now.

There are two positions which we could take in regard to the 1935 infestation. One would be the withdrawal of all control operations for the spring of 1936 to determine what course the infestation

is going to take, or a program of maintenance control could be continued. Naturally, we should like to recommend that no control be instituted and that the infestation be allowed to continue its present course, feeling that by such action no irrecoverable loss will occur. From a thorough study of the problem, which we hope we will be able to make, it is believed that information would be secured that would contribute to a more thorough understanding of the problem. However, control work could again be instituted by the personnel of the CCC camps which are now available to the Sissons and Yellow Dog areas, in an attempt to again reduce the loss on these units. This control would not have any direct effect upon the Steamboat or Little North Fork drainages, where we could also watch the progress of the infestation. In adopting the latter plan I would suggest the institution of control on the Sissons, Yellow Dog River, Downey Creek, and North Yellow Dog units. This would involve the treatment of 4,773 trees on 11,840 acres. It is doubtful if this amount of territory could be covered by the CCC man-power available, and it might be necessary to augment this strength with regular crews from an auxiliary appropriation. On the Little North Fork, Iron Creek and Cascade Creeks carry a rather heavy infestation; however, it is understood that these areas are to be logged in the very near future, so it is possible that the expenditure required would not be justified. We should be pleased to have your reaction to this situation and, if you so desire, I can come to Missoula to discuss the matter with you if you do not plan to visit Coeur d'Alene some time in the near future.

Very truly yours,

James C. Evenden

James C. Evenden
Entomologist

cc to:
Dr. Craighead - 2
Mr. Miller
Mr. Keen
Mr. Beal

Enclosure

THE SEVENTH ANNUAL SURVEY OF THE MOUNTAIN PINE BEETLE INFESTATION IN THE COEUR D'ALENE NATIONAL FOREST

The mountain pine beetle infestation that has been developing in the white pine stands of the Coeur d'Alene National Forest for the past several years has been closely followed by annual cruises of the mature timber. The surveys have been instituted to determine, as accurately as possible, the number of trees killed per year in each of the units into which the forest has been divided. By comparing the infestation from year to year, increases or decreases in the number of trees killed are shown, and it is from these data, supplemented with observations of brood conditions, that recommendations for control projects are drawn. As the infestation within a unit increases or decreases from year to year, an attempt is made to find some logical reason for the occurrence. In some instances an increase in the number of infested windfalls materially increases the number of infested trees per acre, because fewer insects are required to infest a non-resistant windfall than a standing tree. In such an event the insects make more attacks per acre but fewer attacks per tree. Many factors other than just numbers of attacked trees per acre must be considered before control measures are justified.

During the past six years nearly 50,000 infested white pine have been treated to destroy the insect broods in them, in an attempt to curb the infestation. These projects have ranged from forest wide clean-ups to the treatment of a few small heavily infested centers. The method of control has been changed from peeling to burning, and from the treatment of every infested tree found to the leaving of trees in which the broods were highly parasitized.

The following table shows the conditions existing on the forest for the past eight years.

COEUR D'ALENE FOREST SUMMARY

	1928	1929	1930	1931	1932	1933	1934	1935
Acres Surveyed	9,000	99,540	107,830	127,550	127,430	124,320	118,410	113,910
New Attacks per Acre	.278	.300	.087	.098	.118	.157	.207	.184
Percent of Increase	No Data	No comparison	-71	+13	+20	+33	+32	-11
Percent Windfalls	No Data	No Data	No Data	56	50	51	47	16
Infested Trees	2,500	29,881	9,371	12,496	1,100 C.L. 14,457	19,520	24,466	20,952
Acres Recommended for Control	9,000	99,540	61,770	52,120	32,940	3,200	23,880	
Trees Estimated for treatment	2,500	25,904	6,801	8,717	1,100 C.L. 6,757	1,281	6,725	
Year in which Control was conducted	1929	1930	1930 Fall 1931	1932	1932 Fall 1933	Fall 1933	1935	
Acres Treated	5,620	73,210	39,180	40,666	27,204	3,622	9,213	
Trees Treated	1,074	22,926	7,106	270 C.L. 7,906	1,135 C.L. 6,434	877	186 Med. 2,834	283 Med.

C.L. - Cull Logs. (2 C.L. - 1 tree for comparison)
Med. - Treated by experimental medication

It will be seen that there was a steady increase of infested trees per acre since 1930, which reached a peak in 1934. During this time a high percentage of the infestation occurred in windfalls, which declined from 47 percent of the total infestation in 1934 to 16 percent in 1935. Data secured during the 1933 and 1934 surveys indicated very strongly that wherever an increase in the amount of windfall or other non-resistant material occurred, the attacks were noticeably lighter than during the preceding year. The reverse is also true: a decrease in non-resistant host material nearly always brings about a decrease in the number of trees attacked, but at the same time causes an increase in the severity of attacks. Because of the variation in intensity of attacks, a decrease in the number of infested trees per acre does not always mean a decrease in the number of attacks on an acre.

The present situation on the Coeur d'Alene forest is an example of such a concentration of attacks in resistant standing timber. The 1935 attacks, being nearly all in standing trees that occur largely in groups, are the heaviest that the writer has ever seen. Many of the infested trees have over 25 attacks per square foot of bark surface.

In the following tables each of the forest units will be discussed separately, because in many instances each presents a different problem. In the short tables given for each unit, which show the number of acres, 1935 infested trees, percent of stand infested, and the number of infested windfalls and standing trees per acre, is also in-

cluded the percentage of attacks rated as to severity. It is recognized that the data as to severity of attack were taken by non-technical men; and, during the 1933 and 1934 surveys, represented their reaction to each tree as it was examined. To permit an easy classification, they were marked either as heavy, medium, or light in relation to other infested trees on the forest. During the 1935 survey an attempt was made to correlate the severity of attack more closely. Accordingly, as each tree was examined it was classed as heavy, medium, or light according to the number of attacks per square foot of bark surface. Thus a tree with from 1 to 5 attacks per square foot was classed as light; one with 6 to 9, medium; and 9+, heavy. This classification was used because it closely approaches the reaction as to heavy, medium, and light classes of 1933 and 1934 and is not to be taken as a standard classification. It is given only as something more definite than numbers of trees attacked and serves to show the trend from year to year. The percent-of-stand figure is given because the units vary as to the number of green trees per acre.

LITTLE RIVER DISTRICT

Forks Unit: 1,100 Acres - 305 Infested Trees - 1.63 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.043		.014		.055	
Windfalls	.056		.324		.222	
Total	.099	-36%	.338	+241%	.277	-18%
Percent of Attacks:						
Heavy	43		13		0	
Medium	43		54		40	
Light	14		33		60	

Control measures were instituted in the Forks Unit in 1930 and again in 1932. A decrease occurred following each project, but an increasing abundance of windfall material caused an increase in the number of attacked trees per acre in 1934. However, a decrease in the severity of attack and general infestation during 1935 indicates a more favorable condition. The infestation is still confined to 80 percent windfalls, which, when this material is exhausted, should decrease rapidly. The logging operations in the vicinity of the unit should also be a helpful factor in reducing the infestation.

Tom Lavin Unit: 3,000 Acres - 174 Infested Trees - .97 percent of stand

New Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.024		.058		.026	
Windfalls	.071		.075		.032	
Total	.095	-6%	.133	+40%	.058	-56%
Percent of Attack:						
Heavy	58		13		11	
Medium	33		31		22	
Light	9		56		67	

Control operations in 1930, 1931, and 1932 reduced this infestation from .209 to .090, where it has remained with minor fluctuations until the decrease this year. Logging operations of the past summer were no doubt a factor in this reduction, as many of the insects attacked the logs and are subsequently destroyed or removed when the logs are taken out to the mills.

Iron Creek Unit: 4,120 Acres - 1,351 Infested Trees - 2.05 percent of stand.

New Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.052		.081		.323	
Windfalls	.112		.257		.005	
Total	.164	+61%	.338	+106%	.328	-3%
Percent of Attacks:						
Heavy	68		30		81	
Medium	14		40		14	
Light	18		30		5	

Control measures in this unit in 1930 reduced the infestation from .165 per acre to .050. A further natural reduction to .019 occurred in 1931. However, a large number of windfalls which occurred in 1931 and 1932 caused an increase of over 400 percent. As windfalls sometimes remain suitable for host material for three years, this infestation increased steadily during 1932, 1933, and 1934. Very few windfalls were available for host material in 1935, and the insects were forced into standing trees, which they attacked very heavily with only a small percent of decrease in the number of trees per acre.

Cathcart Creek Unit: 3,200 Acres - 160 Infested Trees - 1.00 percent of stand.

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.058		.034		.050	
Windfalls	.000		.075		.000	
Total	.058	-75%	.109	+88%	.050	-54%
Percent of Attacks:						
Heavy	72		0		64	
Medium	14		15		36	
Light	14		85		0	

Control measures were conducted in 1930 and again in 1933. Reductions followed both operations, but increases ocourred, as 67 percent of the infestation was in windfalls in 1932 and 69 percent in 1934. It is interesting to note the high percentage of heavy attacks during the

two years that showed a decrease in the infestation and during which there were no attacked windfalls. The reverse is true for 1934, when 69 percent of the infested trees were windfalls.

Cascade Unit: 3,640 Acres - 732 Infested Trees - 1.26 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.169		.042		.169	
Windfalls	.183		.125		.032	
Total	.352	+283%	.167	-52%	.201	+20%
Percent of Attacks:						
Heavy	76		18		68	
Medium	12		43		16	
Light	12		39		16	

Control measures instituted in 1930 against an infestation of .352 infested trees per acre were successful in reducing it to .078 per acre. Small increases occurred in 1931 and in 1932, but in 1933 it had again reached .352 infested trees per acre. During the fall of 1933, 887 infested trees were burned and 200 trees containing parasitized brood were left. The following reduction of 52 percent was quite satisfactory considering that no control measures were undertaken in adjacent areas. The present increase is due to the dropping from the unit of 1,000 acres in Barney Creek. Barney Creek has always been included in the Cascade area, and as there has never been more than a very light infestation, its

inclusion has had a tendency to reduce the Cascade figure by about .040 infested trees per acre. Had Barney Creek been included, the present figure would be .162 for Cascade Unit. However, intensive logging during the past year in Barney Creek has reduced the timber stand to about three white pine per acre, and it is no longer felt necessary to include it in the survey.

Picnic Creek Unit: 1,680 Acres - 150 Infested Trees - 2.97 percent of stand.

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.111		.018		.089	(30% LPP)
Windfalls	.000		.268		.000	
Total	.111	+22%	.286	+158%	.089	-69%
Percent of Attacks:						
Heavy	75		6		100	
Medium	25		44		0	
Light	0		50		0	

This unit, somewhat similar to Cathcart in that it has been logged off in recent years, follows the same trend. Logging operations in opening up the stand cause an increase in the number of windfalls for the following few years. After the windfall material is exhausted and the insects are forced into standing trees, a sharp decrease is usually noticeable.

Honeysuckle Unit: 5,320 Acres - 931 Infested Trees - 1.35 Percent of Stand

Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.055		.121		.143	
Windfalls	.027		.100		.032	
Total	.082	-49%	.221	+169%	.175	-21%
Percent of Attacks:						
Heavy	59		17		45	
Medium	29		36		34	
Light	12		47		21	

Control measures have been applied to the infestation in the Honeysuckle Unit during the years of 1930, 1933, and 1935. In each instance substantial reductions followed, although only the 1930 project effected a complete clean-up. To combat the increase of 1934, it was recommended that 2,560 acres of the area be covered to treat an estimated 922 infested trees. In the fall of 1934, 186 trees were experimentally treated by medication, while in the spring of 1935, 353 infested trees were treated by peeling and by burning. During the project 1,972 acres of the area were covered.

Leiberg Unit: 4,440 Acres - 506 Infested Trees - .95 Percent of Stand

Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.013		.039		.094	
Windfalls	.007		.137		.020	
Total	.020	-80%	.176	+780%	.114	-35%
Percent of Attacks:						
Heavy	33		11		65	
Medium	33		22		29	
Light	33		67		6	

Control measures were instituted on this unit in 1930 and again in 1932. Reductions immediately followed and after the 1932 project were sustained for two years. However, a sharp increase in windfalls in 1934 again caused a corresponding increase in the infestation.

Laverne Creek Unit: 2,560 Acres - 374 Infested Trees - .77 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.046		.049		.125	
Windfalls	.000		.061		.021	
Total	.046	-63%	.110	+139%	.146	+33%
Percent of Attacks:						
Heavy	20		11		14	
Medium	80		33		64	
Light	0		56		22	

As in most other units a reduction in the number of infested trees per acre followed the two control projects of 1930 and 1933. In both instances increases occurred the second year following control measures. This could be partly accounted for by windfalls and is probably partly due to a concentration of heavy, crowded stands along the creek bottom. The weakened trees in such stands, which would die as a natural thinning measure, are often attacked by insects. This, no doubt accounts for the high percent of medium attacks in an infestation which is composed of nearly all standing trees.

Copper Creek Unit: 4,000 Acres - 576 Infested Trees - .96 Percent of Stand

New Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.077		.080		.124	
Windfalls	.026		.019		.020	
Total	.103	-2%	.099	-4%	.144	+45%
Percent of Attacks:						
Heavy	62		50		36	
Medium	25		50		41	
Light	13		0		23	

Although control measures have never been instituted in Copper Creek, the infestation has steadily decreased from a high of .156 reached in 1931, with 72 percent windfalls, to .099 in 1934. The present increase is unaccountable unless it is due to the cessation of logging operations in part of the area in 1934. It is possible that prior to the present year a part of the general infestation was taken out annually in the form of infested logs.

LITTLE RIVER SUMMARY

	1929	1930	1931	1932	1933	1934	1935
Acres Surveyed	20,070	34,950	36,640	37,260	34,060	34,060	33,060
New Attacks per Acre	.229	.060	.091	.132	.121	.188	.159
Percent of Increase	No Data	-74	+52	+45	-8	+55	-15
Percent of Windfalls	No Data	No Data	57	53	45	67	17
Infested Trees	5,777	2,099	3,329	4,924	4,130	6,398	5,259
Acres Recommended for Control	20,070	8,070	11,240	8,460	3,200	2,560	
Trees Estimated for Treatment	Red Top survey 1,800	707	1,956	1,742	1,281	922	
Year in Which Control was conducted	1930	1931	1932	1933	Fall 1933	1935	
Acres Treated	25,230	4,947	8,862	7,578	3,622	1,972	
Trees Treated	5,777	616	1,046	1,869	887	186 Medicated 353	

GRIZZLY MT. DISTRICT

Taylor's Unit: 2,800 Acres - 378 Infested Trees - .84 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.043		.151		.115	
Windfalls	.245		.008		.020	
Total	.288	+433%	.159	-45%	.135	-15%
Percent of Attacks:						
Heavy	42		57		33	
Medium	26		33		42	
Light	32		10		25	

The infestation in this unit decreased annually since the control work of 1931 with the exception of 1933 when infestation of windfalls caused a sharp increase. It again decreased in 1934, however, and the present year's infestation also shows a slight decrease.

Forks-Cabin Unit: 5,440 Acres - 1,218 Infested Trees - .50 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.093		.184		.194	
Windfalls	.185		.049		.030	
Total	.278	+112%	.233	-16%	.224	-4%
Percent of Attacks:						
Heavy	30		27		60	
Medium	41		35		20	
Light	29		38		20	

The Forks-Cabin Unit in the heart of the heavy white pine stands

of Steamboat has been a very difficult one on which to secure results from control measures. Control measures have been applied during 1929, 1930, 1931, and 1933. It was one of the first units where an attempt at biological control was made by preserving infested trees in which the broods were heavily parasitized. The control measures were instituted early in 1933, and 713 trees were treated and about 200 left because they showed evidence of heavy parasitism. The 1933 infestation showed a sharp increase, but a corresponding increase was found in the percent of parasitism. The 1934 infestation decreased slightly without control measures, although this could easily have been due to a decrease in the number of infested windfalls. The 1935 decrease of 4 percent is probably due to the same cause.

One factor which presents a difficulty in attempts at controlling the infestation within the entire Steamboat area is the presence of root fungus which prevails throughout the stand. This infection is apparently much more prevalent on the ridge between the Little East Fork and the East Fork of the Steamboat. Hundreds of white pine and other species in this area are infected with the fungus. Such weakened trees offer little resistance to insect attack and are therefore excellent host material.

Can Creek Unit: 1,760 Acres - 352 Infested Trees - .83 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.014		.000		.188	
Windfalls	.041		.118		.012	
Total	.055	-37%	.118	+114%	.200	+69%
Percent of Attacks:						
Heavy	50		25		57	
Medium	25		50		43	
Light	25		25		0	

The infestation on this unit decreased from 1930 to 1933. However, the present increase seems to indicate a general upward trend to equal the infestation on the Forks-Cabin Unit, which it adjoins and which no doubt has a decided influence on the status of the infestation.

West Fork Unit: 3,960 Acres - 388 Infested Trees - .54 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.104		.038		.084	
Windfalls	.072		.061		.014	
Total	.176	+71%	.099	-44%	.098	-1%
Percent of Attacks:						
Heavy	45		0		58	
Medium	32		75		21	
Light	23		25		21	

Except in an increase in heavy attacks, this unit is virtually the same as last year.

Clay Creek Unit; 2,320 Acres - 629 Infested Trees - .69 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.150		.139		.203	
Windfalls	.096		.101		.068	
Total	.246	+47%	.240	-2%	.271	+13%
Percent of Attacks:						
Heavy	36		25		69	
Medium	18		42		9	
Light	46		33		22	

Control measures in 1930 and 1931 reduced the infestation from .210 per acre to .054 in the fall of 1931. An increase of 210 percent in the summer of 1932 brought the infestation up to .167 per acre. Control measures were instituted against this infestation in the spring of 1933 and, although 497 trees were treated, a 47 percent increase occurred during the following summer. However, as in the adjacent Forks-Cabin Unit, infested trees containing parasites were left untreated. Although under the same treatment the Forks-Cabin Unit increased 112 percent the following summer and then showed light decreases for 1934 and 1935, the Clay Creek area decreased but 2 percent in 1934 and increased 13 percent in 1935.

Lower Cougar Creek Unit: 3,600 Acres - 634 Infested Trees - 1.10 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.087		.106		.162	
Windfalls	.102		.019		.014	
Total	.189	+26%	.125	-34%	.176	+41%
Percent of Attacks:						
Heavy	18		38		54	
Medium	23		47		46	
Light	59		15		0	

Control measures of 1930, 1931, 1932, and 1933 apparently had little effect on the infestation except for the first year. The infestation rose steadily from .059 trees per acre in 1930 to .189 in 1933. The decrease of 34 percent which occurred in 1934 is nearly offset by the 1935 increase of 41 percent. Although the percent of infested windfalls has decreased since 1932, there has been no corresponding decrease in the general infestation.

Upper Cougar Unit: 3,700 Acres - 444 Infested Trees - .80 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.010		.026		.087	
Windfalls	.105		.006		.033	
Total	.115	-18%	.032	-72%	.120	+275%
Percent of Attacks:						
Heavy	50		20		46	
Medium	23		20		27	
Light	27		60		27	

The infestation decreased for two consecutive years following the 1933 spring control work. The present 275 percent rise is an unexpected increase considering the small amount of infestation present last year.

Bumblebee Unit: 3,040 Acres - 444 Infested trees - 1.12 Percent of Stand

New Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.114		.117		.146	
Windfalls	.038		.000		.000	
Total	.152	+407%	.117	-23%	.146	+25%
Percent of Attacks:						
Heavy	52		65		69	
Medium	24		35		23	
Light	24		0		8	

The logging operations of 1934 no doubt caused a check in the infestation and the decrease of that year. As is usual following logging, there is a small increase this year. However, the usual increase immediately following logging practices is nearly always traced to windfalls caused by the opening up of the stand.

GRIZZLY MOUNTAIN SUMMARY

	1928	1929	1930	1931	1932	1933	1934	1935
Acres Surveyed	9,000	31,913	23,380	27,460	27,620	27,620	26,620	26,620
New Attacks Per Acre	.278	.158	.073	.083	.109	.197	.142	.168
Percent of Increase	No Data	-43	-54	+14	+31	+81	-28	+18
Percent Windfalls	No Data	No Data	No Data	26	57	60	22	14
Infested Trees	2,500	5,059	1,708	2,288	3,008	5,441	3,780	4,487
Acres Recommended for Control	9,000	31,913	18,260	10,700	15,060	None	None	
Trees Estimated for Treatment	2,500	5,059	1,124	1,742	2,156			
Year in Which Control was Conducted	1929	1930	1930 Fall 1931	1932	1933			
Acres Treated	5,620	17,000	11,145	10,442	12,827			
Trees Treated	1,074	3,604	1,930	2,119	2,478			

SHOSHONE DISTRICT

Sissons Unit: 4,700 Acres - 1,438 Infested Trees - 1.22 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.212		.298		.296	
Windfalls	.044		.012		.010	
Total	.256	+109%	.310	+21%	.306	-1%
Percent of Attacks:						
Heavy	67		22		15	
Medium	15		45		43	
Light	18		33		42	

Yellow Dog River Unit: 2,140 Acres - 1,070 Infested Trees - 2.27 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.223		.427		.467	
Windfalls	.162		.004		.033	
Total	.385	-34%	.431	+12%	.500	+16%
Percent of Attacks:						
Heavy	65		14		21	
Medium	16		42		10	
Light	19		44		69	

Yellow Dog Creek Unit: 4,120 Acres - 573 Infested Trees - .40 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.034		.100		.086	
Windfalls	.041		.093		.053	
Total	.075	-44%	.193	+157%	.139	-28%
Percent of Attacks:						
Heavy	88		21		48	
Medium	6		46		22	
Light	6		33		30	

Downey Creek Unit: 4,160 Acres - 1,593 Infested Trees - 1.06 Percent of Stand

New Attacks Per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.141		.265		.300	
Windfalls	.058		.029		.083	
Total	.199	+29%	.294	+48%	.383	+30%
Percent of Attacks:						
Heavy	67		21		33	
Medium	25		40		42	
Light	8		39		25	

The four units of Sissons, Yellow Dog River, Yellow Dog Creek, and Downey Creek have nearly always been the most heavily infested units on the forest. Control measures were applied annually from 1930 to 1934. Although in some instances decreases followed control measures, often the infestation remained practically the same or even increased. The greatest

factor contributing to the failure of control measures in these areas is thought to be the presence of badly infected centers of root fungi. During the 1933 and 1934 surveys it was found that only from 6 to 9 percent of the attacked trees could be considered healthy timber. Although no data of that nature is available from the 1935 survey, the condition is no doubt similar. The tendency of the infestation is toward light attacks, while in nearly all other units on the forest heavier attacks predominate in 1935. This condition indicates the non-resistance of the stand.

Because a great abundance of such weakened material existed on these areas, it was thought best to institute control measures in 1935 on all of the Yellow Dog, Downey, and Sissons group. The original area for which control was considered necessary contained 15,120 acres. However, when it was found that the entire area could not be worked because of the transportation problem of CCC labor, and funds would not permit the area being worked by NIRA camps, the area was cut down to 6,000 acres with an estimated 3,300 trees. Of this 6,000 acres, 3,359 were actually worked and 1,551 trees were treated. The greatest portion of the control work was done in the Sissons Unit (2,709 acres) and the balance (680 acres) was worked in the Yellow Dog River Unit.

North Yellow Dog Unit: 840 Acres - 672 Infested Trees - 3.00 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.019		.140		.683	
Windfalls	.356		.094		.117	
Total	.375	+4%	.234	-38%	.800	+242%
Percent of Attacks:						
Heavy	56		27		80	
Medium	41		53		10	
Light	3		20		10	

The North Yellow Dog Unit, although lying adjacent to the Yellow Dog River area, presents a somewhat different situation. While many of the trees in the stand are infected with root fungi, the condition is not nearly as prevalent as in the adjoining units. The preponderance of heavy attacks in this unit, in contrast to the numerous lightly attacked trees in those adjacent, indicates a more resistant stand. The 1935 infestation occurs in relatively large groups of extremely heavily attacked trees. Many of the trees examined had 30 or more attacks per square foot of bark at the base. Parasites were quite numerous in the brood examined.

Lower Flat Creek Unit: 4,120 Acres - 107 Infested Trees - .15 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.112		.130		.007	
Windfalls	.112		.044		.019	
Total	.224	+1%	.174	-22%	.026	-85%
Percent of Attacks:						
Heavy	78		36		75	
Medium	19		39		25	
Light	3		25		0	

The 1935 control work by a NIRA camp was highly successful. Slightly more than the area recommended for treatment was covered with evident efficiency.

Bennett Creek Unit: 580 Acres - 124 Infested Trees - .71 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.000		.196		.178	
Windfalls	.500		.059		.036	
Totals	.500	+210%	.255	-49%	.214	-16%
Percent of Attacks:						
Heavy	30		54		33	
Medium	35		31		33	
Light	35		15		33	

The Bennett Creek Unit was included in the Flat Creek control area and was treated by a NIRA camp.

Brett-Miner Unit: 1,550 Acres - 310 Infested Trees - 2.00 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.028		.129		.186	
Windfalls	.097		.032		.014	
Total	.125	+15%	.161	+29%	.200	+24%
Percent of Attacks:						
Heavy	90		45		71	
Medium	10		40		0	
Light	0		15		29	

Rock City Unit: 1,600 Acres - 107 Infested Trees - .52 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.102		.104		.027	
Windfalls	.198		.017		.040	
Total	.300	+868%	.121	-60%	.067	-45%
Percent of Attacks:						
Heavy	66		64		60	
Medium	11		29		20	
Light	23		7		20	

The Brett-Miner Unit and part of the Rock City Unit were treated last spring by a NIRA camp. These two areas, on the edge of the 1931 Rock City burn, have no doubt been influenced in the past by insect broods from weakened trees along the border of the burn in Miner Creek. This is apparent in the 868 percent increase which occurred in 1933 and in the

constant increases occurring in the Brett-Miner Unit.

The 1935 control work was apparently quite effective in the Rock City Unit, in which the infestation was already on the decline. The Brett-Miner Unit, nearer to the weakened timber, is evidently still influenced by its presence.

Hawksite Unit: 8,780 Acres - 834 Infested Trees - .72 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.046		.053		.084	
Windfalls	.074		.040		.011	
Total	.120	+243%	.093	-22%	.095	+2%
Percent of Attacks:						
Heavy	3		16		29	
Medium	64		57		47	
Light	33		27		24	

Although no control measures have been applied to the Hawksite area since the spring of 1932, the infestation remains about the same. As in many other areas the increases or decreases seem to depend on the amount of windfall material available.

Cabin Creek Unit: 7,000 Acres - 1,561 Infested Trees -1.59 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.060		.123		.186	
Windfalls	.070		.110		.037	
Total	.130	+519	.233	+79%	.223	-4%
Percent of Attacks:						
Heavy	50		44		47	
Medium	9		41		39	
Light	41		15		14	

Control measures were first conducted on the Cabin Creek area in 1931. For the following two years of 1931 and 1932 decreases followed. In 1933, however, an increase of 519 percent occurred, which was followed by a further 79 percent increase in 1934. Because the infestation of 1934 was largely in heavily attacked standing timber, control measures were first recommended for the entire 7,000-acre unit. When it was found that insufficient funds were available to carry out the original plans, the area was cut to 1,760 acres, of which 1,302 acres were worked. During the project 496 trees were left because the broods were heavily parasitized. The leaving of such parasitized broods would have no effect on the number of attacks in 1935. The emerging parasites would attack the developing 1935 brood but would obviously not reduce the number of attacks that had taken place. The effect these parasites might have in reducing the infestation would not be felt until the attacks of 1936.

No survey was conducted in Falls or Eagle Creek during 1935 because inclement weather hastened the end of field work. However, it is not felt that any serious developments could have occurred in either area, as Falls Creek is sparsely timbered and Eagle Creek is quite isolated from other white pine stands.

SHOSHONE SUMMARY

	1929	1930	1931	1932	1933	1934	1935
Acres Surveyed	34,728	34,860	48,810	47,910	47,910	43,090	39,590
New Attacks Per Acre	.281	.129	.125	.125	.169	.201	.212
Percent of Increase	No Data	-54	-3	0	+35	+19	+5
Percent Windfalls	No Data	No Data	63	40	50	22	16
Infested Trees	9,772	4,495	6,091	1,100 C.L. 5,417	8,113	8,673	8,389
Acres Recommended for Control	34,728	29,680	24,180	9,420	None	21,320	
Trees Estimated for Treatment	9,772	4,248	4,393	1,100 C.L. 2,859		5,803	
Year in Which Control was Conducted	1930	1930 Fall 1931	1932	1932 Fall 1933		1935	
Acres Treated	17,460	19,570	21,362	6,799		7,241	
Trees Treated	8,954	4,085	270 C.L. 4,741	1,135 C.L. 2,087		2,481	

C.L. - Cull Logs (2 C.L. - 1 tree for comparison)

FORKS DISTRICT

Big Elk Unit: 4,960 Acres - 913 Infested Trees - 1.45 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.082		.045		.149	
Windfalls	.089		.303		.035	
Total	.171	+111%	.348	+103%	.184	-47%
Percent of Attacks:						
Heavy	No Data		No Data		69	
Medium					21	
Light					10	

An abundance of windfalls which occurred during the winter of 1931-1932 started an increasing infestation in the Big Elk drainage. The increase continued until 1934, when most of this material became unfit for attack. The decrease of 47 percent in 1935 was caused by the insects being forced into the more resistant standing timber.

Potter Creek Unit: 3,800 Acres - 1,250 Infested Trees - 1.12 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.116		.061		.267	
Windfalls	.068		.667		.062	
Total	.184	+124%	.728	+296%	.329	-55%

The 55 percent decrease of 1935 is due to a decrease of 91 percent windfalls in 1934 to 19 percent in 1935. The present infestation is largely

grouped along the creek bottoms, and the trees are very heavily attacked. An experimental medication project, during which 283 infested trees were treated, was conducted in the more heavily infested part of Potter Creek during the fall of 1935.

Stewart Creek Unit: 2,200 Acres - 161 Infested Trees - .59 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.047		.056		.073	
Windfalls	.016		.296		.000	
Total	.063	-47%	.352	+459%	.073	-79%

The Stewart Creek infestation, which decreased steadily since the 1931 control project until a high percentage of windfall material brought it up to .352 infested tree per acre in 1934, is again showing a decrease. However, the 1935 attacks are all classed as heavy and occur somewhat grouped.

Upper Flat Creek Unit: 3,680 Acres - 493 Infested Trees - .67 Percent of Stand

New Attacks per Acre and Percent of Change in Status

	1933		1934		1935	
Standing	.025		.058		.097	
Windfalls	.016		.038		.037	
Total	.041	0%	.096	+134%	.134	+39%
Percent of Attacks:						
Heavy	80		40		60	
Medium	0		10		40	
Light	20		50		0	

The Upper Flat Creek area, treated very thoroughly in 1930, has made only minor fluctuations until the last two seasons. The infestation is somewhat grouped, and heavy attacks predominate.

FORKS SUMMARY

	1929	1930	1931	1932	1933	1934	1935
Acres Surveyed	12,829	14,640	14,640	14,640	14,640	14,640	14,640
New Attacks Per Acre	.723	.073	.054	.076	.125	.383	.192
Percent of Increase	No Data	-90	-26	+41	+64	+206	-50
Percent Windfalls	No Data	No Data	75	72	51	87	19
Infested Trees	9,273	1,069	788	1,108	1,836	5,615	2,817
Acres Recommended for Control	12,829	5,760	6,000	None	None	None	
Trees Estimated for Treatment	9,273	722	626				
Year in Which Control was conducted	1930	1931					
Acres Treated	13,520	3,518	None				
Trees Treated	4,591	475					Medicated 283

CONCLUSION

In the foregoing tables the percentages of increase or decrease are all given in relation to the number of infested trees per acre. It is probably the only comparison that can be made and yet, as was stated earlier in the report, it does not always give an accurate measurement of the infestation status unless other factors are studied. The influence of windfalls in raising the number of infested trees per acre, out of proportion to the increase in insect brood, must be considered. The reverse is true when such non-resistant host material becomes exhausted and the insects are forced to attack standing trees. In nearly every instance there is a sharp decrease in the number of infested trees per acre, but this does not necessarily mean a decrease in insect population. A better comparison might be made by considering an infested standing tree as equivalent to two infested windfalls, although in the economics of control a windfall is as expensive to treat as a standing tree. If such a weighted comparison were made, the 1935 infestation would be a 3 percent increase over that of 1934.

During the past season there has been a large increase in the percentage of the infestation that is found in standing trees. The infestation during the four years of 1931-1934 ran from 44 to 53 percent in standing timber, while the standing trees in the 1935 infestation represent 84 percent of the total.

As the infestation now present on the forest occurs in more and larger groups than before, and the trees are very heavily attacked, it is

thought it might mark a hopeful phase in the infestation cycle. In many instances some of the large groups of standing trees attacked in 1935 are comparable to similar groups of white snags that were killed by insects sometime prior to 1920. The infestation that swept through the Coeur d'Alene Forest between 1910 and 1920 caused a serious loss of timber. Toward the end of the infestation the insect-attacked trees occurred in large groups that may still be seen as patches of snags scattered throughout the forest. A factor which may also be considered as a favorable sign in the present infestation is the fact that the trees are so very heavily attacked. In such attacks it is thought that the food material of the cambium is not always sufficient to support the brood and mortality sometimes occurs from starvation. Such heavy broods, in constructing egg galleries and larval mines, also open up the entire inner bark, giving easy access to predators that move from one larva to another.

Although it is evident that more timber was killed in the last infestation than is being killed now, it seems that the present infestation is following a comparable course. The writer feels that another year or two of loss is inevitable but that at the same time natural controlling factors are developing which will mark the end of the present infestation cycle.

Respectfully submitted,

T. T. Terrell
Scientific Aid

COST ANALYSIS OF 1935 SURVEY
COEUR D'ALENE FOREST

Transportation	$64.10
Subsistence	261.18
Wages	1,269.38
Total Charge	$1,594.66
Terrell's Salary (1 1/2 Mo.)	262.50
Total Field Cost	$1,857.16

Effective Man-days	166 1/2
Non-Effective Man-days	193
Total Man-days	359 1/2

Cost per Acre of Area Surveyed (113,910)	$.016
Miles of Sample Strip	623
Miles of Sample Strip per Effective Man-day	3.75